Project Details

Environment Agency

NEC4 Professional Service Contract (PSC)

Modelling Technical Scope

Project / contract Information

Project name	WSX Flood Forecasting 5xRRC models (Bride, Doniford, Hawkcombe, Sheppey, Winniford)
Expected completion date	30/08/2022
Version number	5 – Revisions to remove Section 3 from scope and update guidance.
Environment Agency Area	Wessex
Area lead	[redacted]
Modelling technical lead	[redacted]
Contact for additional information	[redacted]

This Scope should be read in conjunction with Real Time Model Development Guidance July 2019 and the LIT 14089 High flow rating curve development using hydraulic models July 2021. The *service is* compliant with the LIT18686 NEC4 Minimum Technical Requirements for Modelling_v3.1 and with LIT 56326 Fluvial Modelling Standards and shall be delivered in accordance with the Modelling & Mapping Framework (MMF)

Background

In response to the Boscastle incident of August 2004, the Environment Agency drew up a national register of catchments which are considered to have a particularly fast response to rainfall events, meaning that the amount of time we have to warn the communities at risk is reduced, deeming that a special flood risk exists. These have been termed Rapid Response Catchments (RRC). The classification of RRC means there is a very high, high or medium flood hazard to the community and an associated loss of life risk.

Where a flood warning service is provided to RRC communities an upstream gauge alone is unlikely to provide sufficient lead time for the community to respond effectively due to the small catchment size. Flood forecasting models pose the most realistic approach of providing the extra time needed to prepare. The following provides some high-level information on the five RRCs at the centre of this work.

The River Winniford in West Dorset drains a small catchment of 8.5km^2 and flows through the community of Chideock before passing through Seatown where it meets the sea. The main flood risk is in Chideock where around 20 properties are at risk of flooding. Chideock is a popular tourist resort, its status as a Gateway Town to the Jurassic Coast attracts many visitors, causing the population to rise significantly during holiday periods. There are several tourist and visitor accommodation facilities along the river, including caravan and campsites.

The Hawkcombe stream rises in North Exmoor, above Porlock where it flows through a very narrow steep sided valley. It runs into the centre of Porlock from the south through the Glen Lodge/Peepout area. The main fluvial risk is to the High Street (A39), Sparkhayes Lane and Parsons Street in the centre of the village where around 72 properties are at high risk of flooding. Porlock's position on the edge of Exmoor means it is a popular tourist centre. As such, the population of Porlock may rise significantly during holiday periods.

The River Sheppey rises approximately 3km to the east of Shepton Mallet. It then flows west in a well-defined valley through Shepton Mallet and Croscombe, which are the main areas of flood risk and have flood history including recent flooding at Croscombe despite installation of property level protection. 147 properties are at flood risk as well as campsites and vulnerable properties.

The Doniford Stream rises on Willett Hill approximately 10km south of Doniford. The stream flows north within a steep sided valley flanked to the east by the West Somerset Railway line. Just north of Sampford Brett, the Doniford Stream enters an expansive floodplain and is joined by the Monksilver Stream. From the confluence of these two streams the watercourse continues as the Doniford stream through the village of Doniford. There are around 33 properties at high risk of flooding located within eight separate communities along the course of the river, but the main flood risk is in Doniford and Sampford Brett. There are high tourist populations in the summer and vulnerable sites within the floodplain, including camping and caravan sites. The River Bride drains a small rural catchment centred on the communities of Long Bredy, Litton Cheney, Puncknowle, Burton Bradstock and the holiday park at Freshwater. The outfall of the River Bride to the sea at Freshwater is of particular interest as the shingle beach is prone to blocking the mouth of the river during storms. This can cause the river to back up into the adjacent caravan and camp site. As the backing up of the river can be quite sudden, Burton Bradstock and Freshwater are both considered as rapid response areas. There are 25 properties at high risk of flooding, mostly located in Burton and Bradstock, but this doesn't take account of the high number of touring and static caravans.

Project Overview

The aim of this project is to develop calibrated flood forecasting models for the following five rapid response catchments (RRC) in Somerset and Dorset:

1. River Winniford at Chideock (high priority RRC)
2. Hawkcombe Stream at Porlock Parsons Street (high priority RRC)
3. River Sheppey at Shepton Mallet Garston Street bypass (high priority RRC)
4. Doniford Stream at Sampford Brett (high priority RRC)
5. River Bride at Burton Bradstock (medium priority RRC)

In order to meet the project aim, the following will be delivered:

- an inception stage report to assess the technical risk and calibration target ranges for each flood warning threshold.
- five hydraulic model derived flood stage-discharge rating reviews.
- a review of the performance of the existing flood warning thresholds for the Hawkcombe Stream at Porlock Parsons Street and development of new river level or flow-based flood warning thresholds at the Hawkcombe Stream at Parsons Street Radar flow recorder.
- a review and peak level-level correlation of the two gauges (flood warning site and flow recorder) at Burton Bradstock & Porlock Parsons Street to investigate the possibility of transferring all the flood warning thresholds to the flow recorder sites (i.e., Burton Bradstock Flow & Porlock Parsons Street Radar).

  All five of the catchments are steep, fast-responding rivers which make flood forecasting challenging due to short lead times. Existing hydraulic models are available for these flood warning sites but they are not flood forecasting models.

  Following completion and delivery of the 5x Inception Reports, the EA is expected to tender the subsequent stage of model development and delivery.

1 Site Visit and Topographic Survey

1.1 Site Visit

The *Consultant* shall:

1.1.1 Read the technical guidance for high flow rating development and use it to plan the site visits to the five flood warning stations and three co-located flow gauging stations. Note that the hydraulic stage-discharge ratings are required to be consistent with in-bank measured flows, to accurately estimate both low river flows and out of bank flood flows up to the 200-year flood and severe flood warning threshold and continue to run up to the 1000-year flood. The flood warning thresholds including the severe flood warning threshold can be found in Appendix A of this scope.

1.1.2 Either collate the 200- and 1000-year design floods for the five flood warning sites or derive the 200- and 1000-year design floods using the Flood Estimation Handbook and in accordance with the Environment Agency's Flood Estimation Guidelines dated 6th July 2020.

1.1.3 Collate and review the existing hydraulic models and survey data at the five flood warning stations and three co-located flow gauging stations (i.e., Porlock Parsons Street Radar, Shepton Mallet Garston and Burton Bradstock flow), to assess what data, survey and hydraulic model development are required in order to derive five flood stage-discharge ratings at:

- Porlock Parsons Street flood warning station or Porlock Parsons Street Radar flow gauging station.
- Burton Bradstock flood warning station or Burton Bradstock Flow gauging station.
- Shepton Mallet Garston Street flow gauging station.
- Chideock flood warning station; and,
- Sampford Brett flood warning station.

1.1.4 Note that the Burton Bradstock and Porlock Parsons Street hydraulic models will also be used to estimate the proposed flood warning thresholds at the Burton Bradstock and Porlock Parsons Street Radar flow gauging stations from the existing flood warning thresholds at the Burton Bradstock flood warning station and Porlock Parsons Street flood warning station.

1.1.5 For the five flood warning stations and the three co-located flow stations, (i.e., Porlock Parsons Street Radar, Shepton Mallet Garston and Burton Bradstock), collate and review the flood warning and flow gauging station details and history, existing flow gauging's and ratings, bypass flow issues at the flow gauging station, any photographs at high flows and other event information.

1.1.6 Arrange for a senior hydraulic modeler (minimum five years' experience in hydraulic modelling) to visit the five flood warning sites and three co-located flow gauging stations with Environment Agency staff who have knowledge of the flood warning station and flow gauging station in order to better understand the technical risks, local flood flow pathways and flood history.

1.1.7 This will involve taking site photographs at the proposed cross-section survey points, specifying a cross-section survey of the main low and high flow controls affecting the five proposed stage-discharge ratings and proposed real-time hydraulic model between Shepton Mallet Garston Street Flow gauging station and the Shepton Mallet Garston Street Bypass flood warning station proposed stage-discharge rating, noting if there is significant flow bypass at the flood warning site and noting the relative location of the flood warning site and nearby flow recorders. The *Client* will facilitate this visit(s) and arrange for appropriate staff to accompany the *Consultant* to provide local knowledge. The *Consultant* shall give the *Client* 10 working days' notice prior to any required visits.

1.1.8 Produce site visit meeting notes and identify pros and cons of deriving a hydraulic model derived stage-discharge rating at:

- Porlock Parsons Street flood warning station or Porlock Parsons Street Radar flow gauging station.
- Burton Bradstock flood warning station or Burton Bradstock Flow gauging station.

1.1.9 Note that a stage-discharge rating is required at Shepton Mallet Garston Street flow gauging station, which is

immediately upstream of the Shepton Mallet Garston Street Bypass flood warning station. Produce a survey specification for five stage-discharge rating hydraulic models at:

- Porlock Parsons Street flood warning station or Porlock Parsons Street Radar flow gauging station.
- Burton Bradstock flood warning station or Burton Bradstock Flow gauging station.
- Shepton Mallet Garston Street flow gauging station.
- Chideock flood warning station; and,
- Sampford Brett flood warning station.

1.2 Topographic Survey

1.2.1 The *Consultant* shall develop a topographic survey scope for *Client* approval using the following:

- LIT 18748 Guidance for Commissioning Surveys_V5.0
- LIT 18749 National Standard Technical Specifications for Surveying Services_V5.0
- LIT18750 National Standard Technical Scope for Commissioning Surveying Services_V5.0

1.2.2 The *Client* shall commission the topographic survey by Others based on the *Consultant* scope provided in 1.2.1. The *Consultant* shall ensure adequate time in the programme is provided to enable the development of the topographic survey deliverables. Note it is expected that data review and assessment can continue whilst survey deliverables are being developed.

1.2.3 The *Client* shall issue the topographic survey deliverables to the *Consultant* for quality assessment and acceptance to enable subsequent hydraulic model development.

1.2.4 The *Consultant* shall use the outputs from the topographic survey in their modelling and design.

2 Flood Forecasting - Inception Stage

2.1.1 The *Consultant* shall deliver the following activities in accordance with the Environment Agency's Real Time Model Development Guidance (July 2019):

- Data review
- Review of existing flood warning information
- Rating curve review
- Review of existing models
- Conceptual modelling approach
- Risk assessment
- Calibration event selection
- Model validation
- Assessment of calibration performance measures
- Agreement of calibration performance targets

2.1.2 In addition, a review of the 0.5m Act Flood Alert threshold and 0.7m Act Flood Warning threshold at Porlock Parsons Street should be undertaken and an explanation given why the 0.7m threshold has not been crossed between 1st Jan 1998 and the present date. Investigate if supercritical flow is occurring at both Porlock Parsons Street (flood warning station) and Porlock Parsons Street Radar (flow gauging station) and whether this is preventing significant variation in the water level at these stations.

2.1.3 Collate the latest version of the Environment Agency derived shapefile “WISKI_open_sites” and the shapefile “SW_Region_HandT_Stations” and use them in conjunction with the Table in section 5.1 to identify all the relevant open & decommissioned raingauges for the five sets of flood warning site catchments that can be used to:

- check the accuracy of the dominant raingauge in conjunction with weather radar rainfall data,
- identify decommissioned raingauges that could be used to extend the rainfall record of relatively short dominant raingauges.

- extend the record of the dominant raingauge if it is relatively short and ensure that a ratio of the double-mass cumulative rainfall values is applied to donor raingauge timeseries.

- improve the resilience of the catchment rainfall

2.1.4 Compare the collated hydrometric data (rated flows, measured flows and water level data) using time series hydrographs and consult with the Environment Agency hydrometric teams, using contact details to be provided by the EA project manager, to better understand the uncertainty in the collated hydrometric data (existing hydrometric stage-discharge ratings, measured flow data & water level data); for example datum differences, bypass flood flow, lack of flood spot flow measurements, index velocity and water level calibration issues, drift error, trash screen blockage etc. Of particular concern is the inconsistency between the four sets of water level data at Porlock Parsons Street and Porlock Parsons Street Radar, which ranges between 0.16m and 0.39m for the peak level of largest flood event between July 2016 and Present.

2.1.5 Compare the frequency of crossing of the 0.5m Act Flood Alert threshold at Porlock Parsons Street flood warning station with the 0.45m Act Flood Alert threshold at the nearby Allerford flood warning station and 0.8m Act Flood Alert threshold at the nearby West Luccombe flood warning station. Graphically compare the water level time series values from the Porlock Parsons Street, Allerford and West Luccombe flood warning sites with the water level values from the Porlock Parsons Street Radar flow gauging station in order to derive Act Flood Alert thresholds at both the Porlock Parsons Street flood warning station and Porlock Parsons Street Radar flow gauging station that are more spatially consistent with the flood alert thresholds at Allerford and/or West Luccombe.

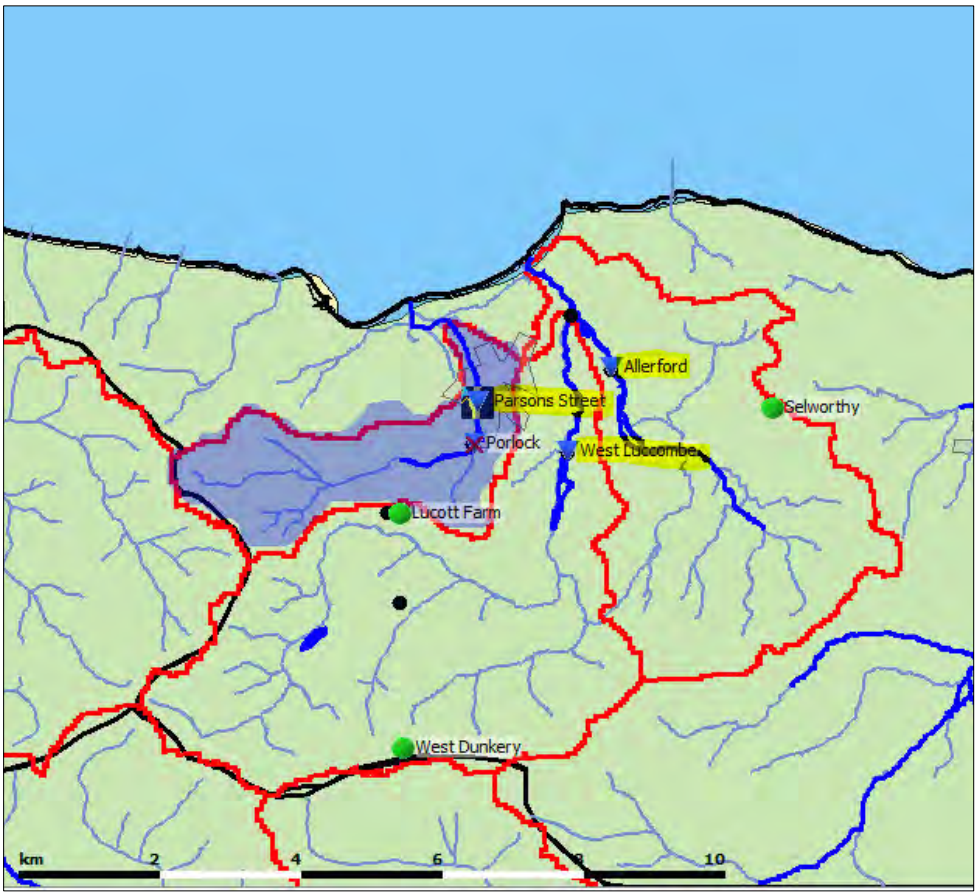


Figure 2-1 Location Map of Porlock Parsons Street, West Luccombe and Allerford Flood Warning Stations

2.1.6 Determine the Result Flood Warning thresholds in both river level and river flow at both Porlock Parsons Street flood warning station and Porlock Parsons Street radar continuous flow and velocity gauging station based on:

- The onset of flooding of the first property to flood in the Hawkcombe valley to Porlock bowling green flood warning area (FWA) and Porlock centre FWA, i.e. two thresholds;

- Flooding of the Sparkhayes camping site in Porlock (TA24 8NE), i.e. one threshold; and,
- The flow required to transport boulders which will block culverts in both the Hawkcombe Valley to Porlock bowling green FWA and/or Porlock centre FWA and hence cause property flooding, i.e. one threshold.

2.1.7 Follow the guidance in the operational instruction LIT 11468 Threshold setting in flood incident management (55_07)'. Record the benefits and limitations of basing the Result Flood Warning thresholds on either water level or flow.

2.1.8 Determine the Flood Warning Act Consider (ACTCON FW) thresholds at Porlock Parsons Street flood warning station and Porlock Parsons Street Radar flow gauging stations for each Flood Warning Result threshold based on the following equation:

ACTCON FW = RES FW – r * (D+L)

Where D = decision making time = 30 minutes

L = the target lead time

r = the rate of rise of water level or water flow appropriate for a flash flood event. This can be done by examining hydrographs from historic events

2.1.9 A review of the Burton Bradstock and Porlock Parsons Street Flood Warning stations and co-located Flow Gauging Stations will be undertaken to establish whether the Flood Warning station can be decommissioned, and the flood warning thresholds transferred to the Flow Gauging Station. The following tasks shall be delivered:

- Compare the level records for both the Flood Warning Station and co-located Flow Gauging Station to establish a correlation between the two sites as it is known that there is some difference and use the stage-discharge rating hydraulic model to extend the peak level-peak level correlation to the highest flood warning threshold.
- Extend the 15-minute water level time series at the Burton Bradstock flow gauging station from 1st Jan 1998-10th June 2010) using the peak level correlation between Burton Bradstock flood warning station and flow gauging station.
- Derive flood warning thresholds for the Burton Bradstock and Porlock Parsons Street Radar Flow Gauging Stations based on the level-level correlation and existing flood warning thresholds presented in Appendix A. Determine if the Flood Warning Station or Flow Gauging Station will give the best stage-discharge rating for high flows and use this to inform a recommendation to decommission the existing Porlock Parsons Street and Burton Bradstock Flood Warning Stations and to transfer the flood warning thresholds to the co-located Flow Gauging Stations.

2.1.10 The inception stage report should review the lessons learnt from the development of a PDM flood forecasting model for the Combe Martin rapid response catchment in North Devon and the Cheddar rapid response catchment in North Somerset. The false alarm ratio of the Combe Martin flood forecast PDM model was reduced by development of a dual-PDM model and timing error was improved through calibration against radar derived catchment rainfall.

2.1.11 The agreement of the calibration target ranges will be influenced by four contributing components of modelling uncertainty following the inception stage data/catchment review described in the Real-Time Model Development Guidance July 2019 quality standard (pages 11-13) and is highlighted in the discussion paper appended to this scope. The project *Consultant* is expected to define what very good, good, fair and poor scores actually mean for the four sources of modelling uncertainty and to discuss and agree with the EA project team at the appropriate stage.

- For example, the raingauge coverage may be "good" for winter flood events caused by widespread (frontal) rainfall but may be "poor" for detecting isolated or embedded localised intense (convective) rainfall events. The data availability may be "good" for low impact flood events that cause flooding of adjacent fields (i.e., Flood Alert threshold), but may be "poor" for high impact flood events that cause property flooding (i.e. ACT or RES Flood Warning threshold).

2.1.12 The total model uncertainty score is used to determine the expected calibration performance. Justification

should be provided by the model developer for the choice of scores, within the model documentation; and scores should be agreed with the Environment Agency, before proceeding with model development/calibration.

2.2 Communication and Deliverables

2.2.1 Produce five flood forecasting inception reports, one for each flood warning site, with the contents list based on the inception stage activities list found on page 5 of the Environment Agency's Real Time Model Development Guidance document, the inception report will also address the tasks listed in the Real Time Model Development Guidance document and the tasks listed in section 2 of this scope.

2.2.2 Produce five rating review inception reports with the contents list based on an extract of Appendix 1 Report contents (The purpose of the study and the present situation) of the LIT 14089 High flow rating curve development using hydraulic models. The rating review inception report will also document the collation or derivation of the 200-year and 1000-year design flows and the severe flood warning threshold in order to define the upper limit of the proposed stage-discharge rating. The rating review inception reports will include the site visit meeting notes and survey specifications as appendices. The rating review inception reports will also address the tasks listed in pages 1 to 16 of the LIT 14089 High flow rating curve development using hydraulic models.

2.2.3 The *Consultant* shall allow 10 working days for the Environment Agency to review the draft inception stage flood forecasting reports, draft inception stage rating review reports and the draft survey deliverables. Please ensure that ample warning of impending documents is provided to the Environment Agency to ensure that resource can be made available. Present the findings and recommendations of the five reviewed flood forecasting inception stage reports and five reviewed rating review inception stage reports to the *Client* via a videoconference meeting for discussion and agreement. The *Consultant* will make summary notes of the meeting to be issued to the *Client* within 7 working days.

2.2.4 The *Consultant* shall allow for monthly videoconference meetings to present progress to the *Client* throughout the duration of the project. The aim of these meetings shall be to allow the *Client* to comment on the ongoing work, answer any queries, and make decisions on the project. The *Consultant* will make summary notes of the meeting to be issued to the *Client* within 7 working days.

2.2.5 The *Consultant* shall ensure that the topographic survey scope comply with LIT 18750 - NEC4 professional services contract (PSC) - Survey Scope Template.

2.2.6 The *Consultant* shall deliver the following services in accordance with LIT 14089 High flow rating curve development using hydraulic models July 2021 for each of the five locations.

2.2.7 Develop a hydraulic model of both the in-bank and out of bank stage-discharge rating.

2.2.8 Ground truth and adjust the hydraulic model derived stage-discharge rating with spot flow measurements and continuous flow measurements, if available.

2.2.9 Check and record within the Inception Report that the top ten flood volumes from the proposed stage-discharge rating at Sampford Brett are spatially consistent with the flood volumes derived from the existing accurate stage-discharge rating at the downstream high flow gauging station at Swill Bridge minus the flood volumes derived from the measured flood flows at Williton (since 1st May 2018) and rated flood flows from the preliminary stage-discharge rating at Williton (Mott MacDonald, March 2013).

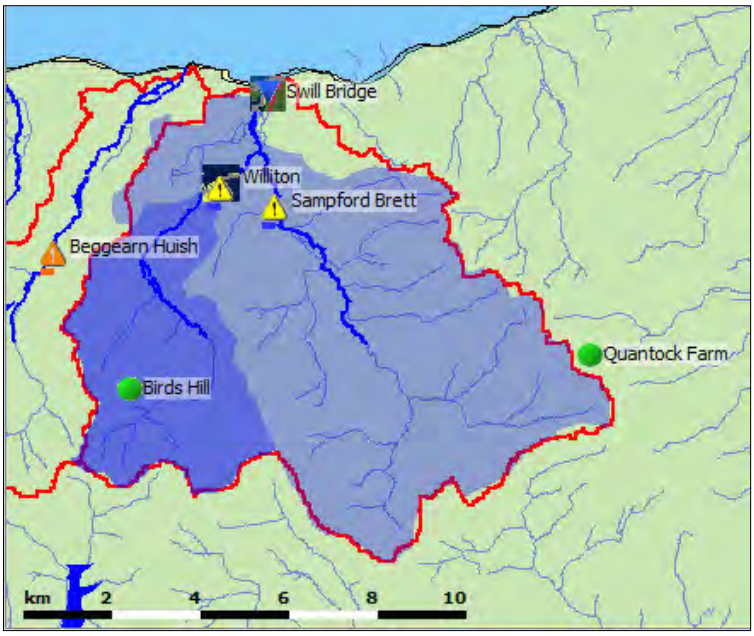


Figure 2-2 Relative locations of the Sampford Brett Flood Warning Station, Williton Flood Warning Station and the Swill Bridge Flow Gauging Station

2.2.10 Check and record within the Inception Report that the top ten flood volumes from the proposed stage-discharge rating at Chideock (area=4.9km2) are spatially consistent with the flood flow volumes derived from the measured flows at the nearest flow gauging station at Bridport Magdalen Lane (area=17.1km2) which have been adjusted by the ratio of the Flood Estimation Handbook QMED's for Chideock and Bridport Magdalen Lane ie 1.0m3/s divided by 3.49m3/s.

2.2.11 Delivery of a rating review report using the report contents list in Appendix 1 of LIT 14089 High flow rating curve development using hydraulic models July 2021 and in pages 6-7 in the "Real Time Model Development Guidance July 2019".

2.2.12 The five rating review reports will also address the tasks listed in LIT 14089 High flow rating curve development using hydraulic models July 2021. The rating review reports will include two appendices of the site visit meeting notes, the survey specifications.

3 Maps of Study Areas

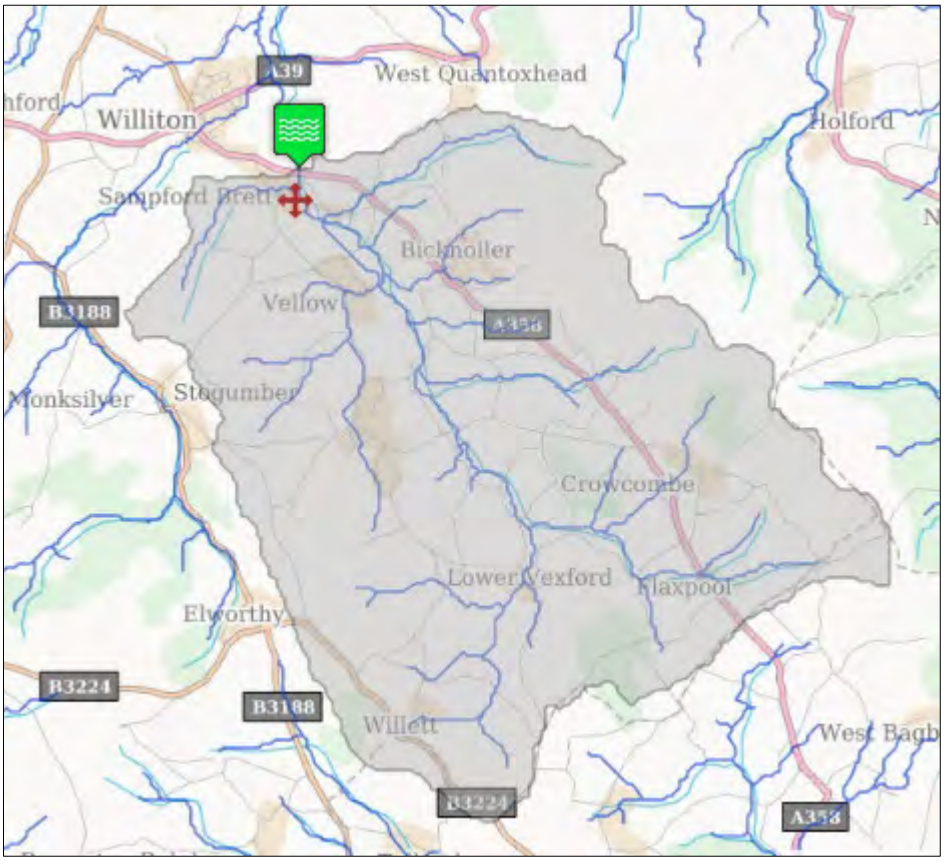
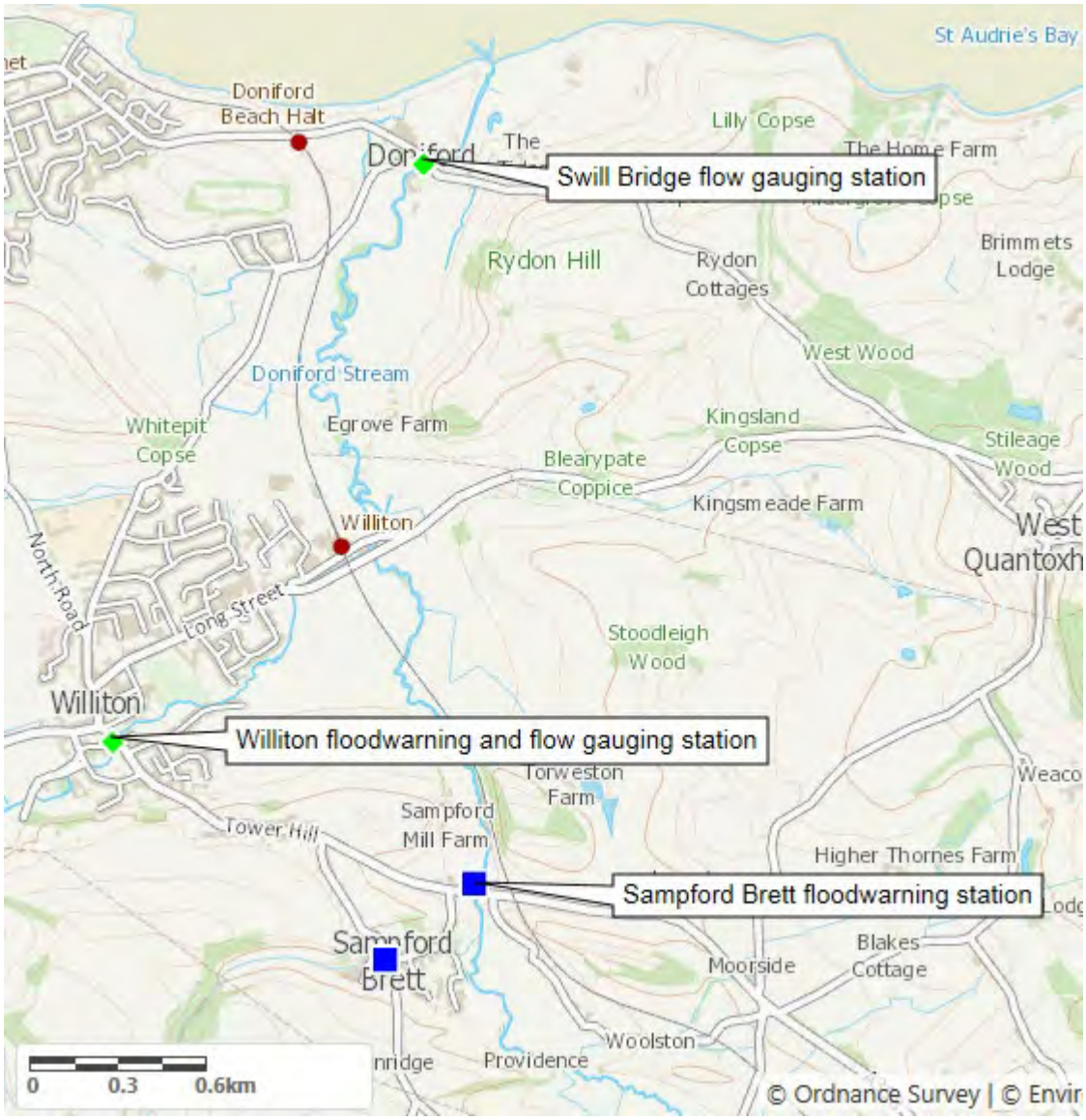


Figure 4-1 – Doniford Stream – Catchment at Sampford Brett (47km^2)



Site map of the Sampford Brett floodwarning station and the Williton and Swill Bridge flow gauging stations

Site photo of Sampford Brett flood warning station

Site photos of Williton floodwarning and flow gauging station (looking downstream and looking upstream)

Site photo of Swill Bridge flow gauging station

Figure 4-3 - Hawkcombe Stream - Catchment at Parsons Street, Porlock (5.3km²)

Site map of the Porlock Parsons Street floodwarning station and Porlock Parsons Street Radar flow gauging station

Site photo of Porlock Parsons Street flood warning station

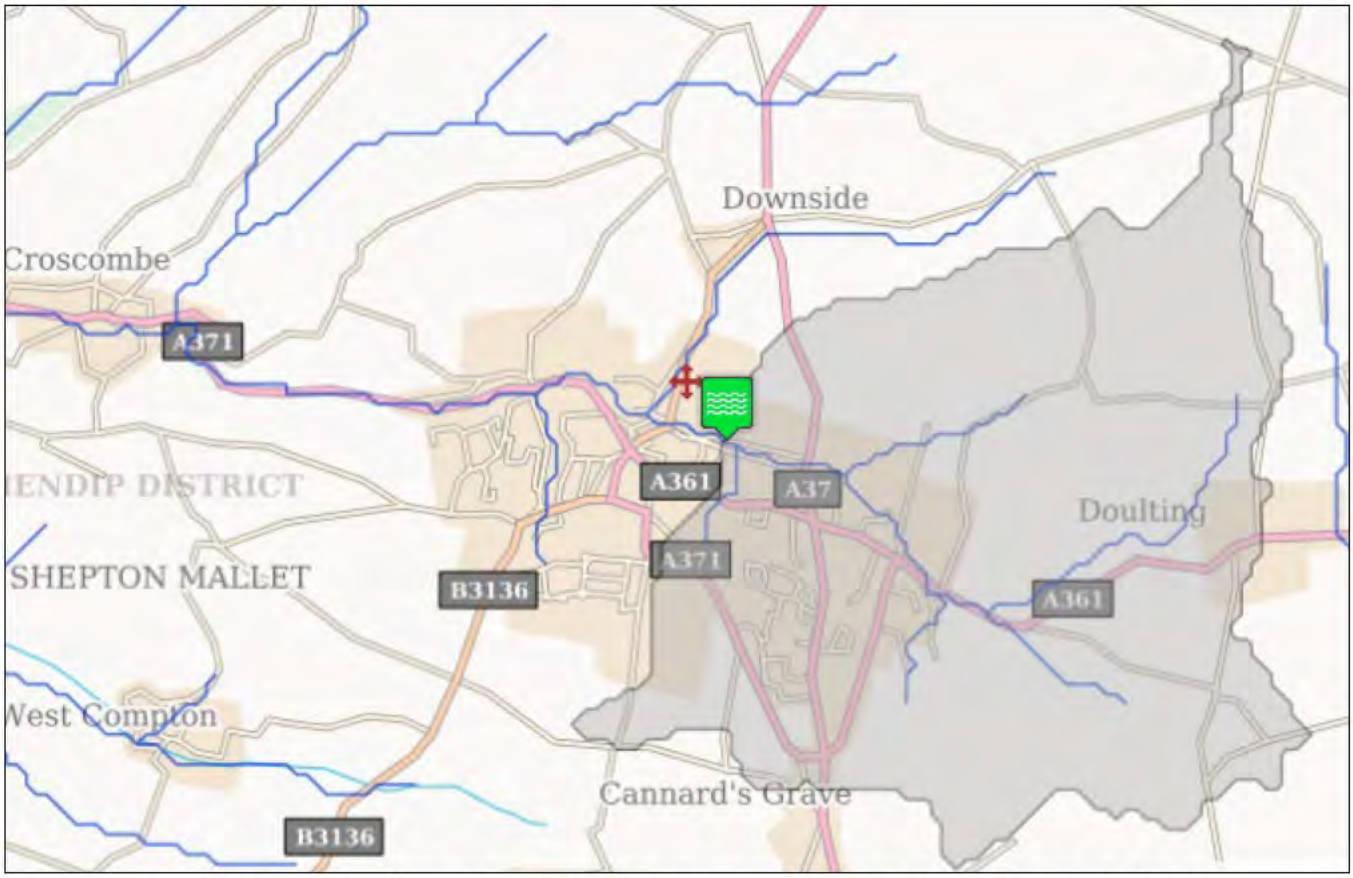
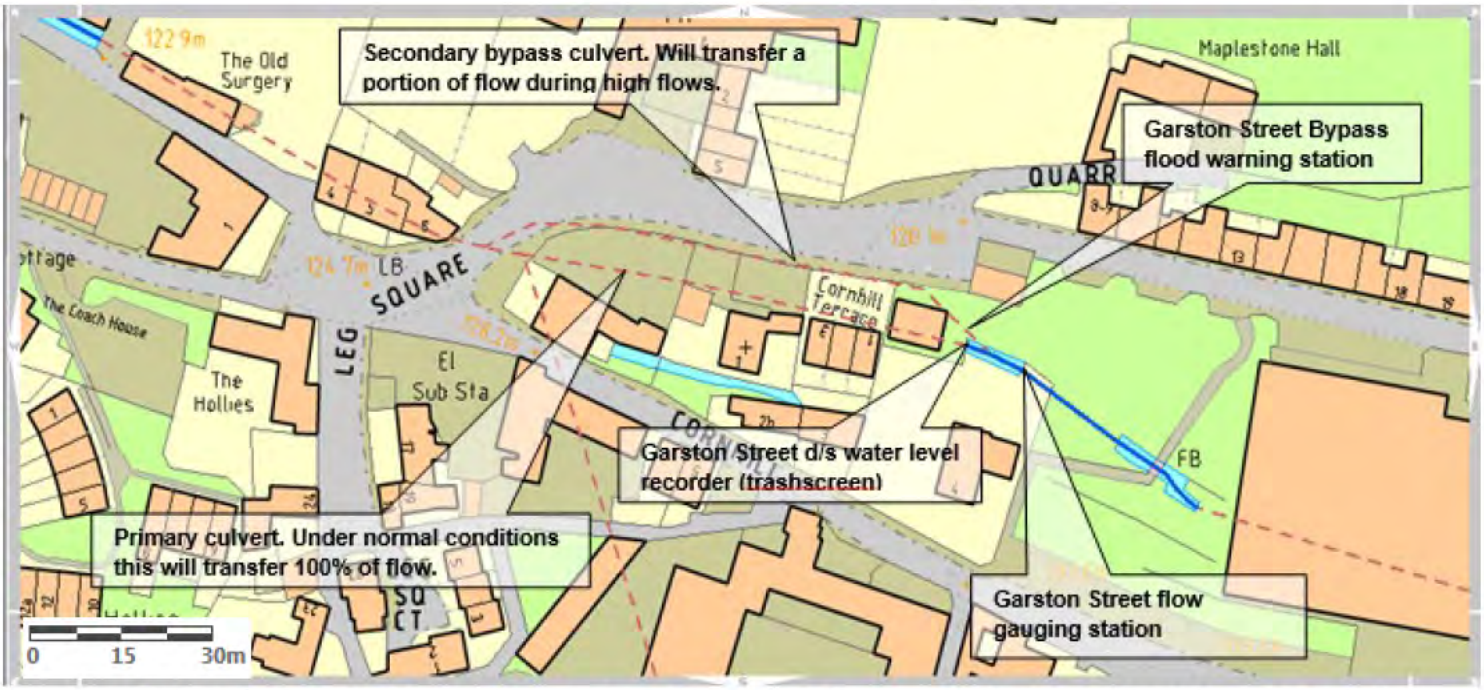
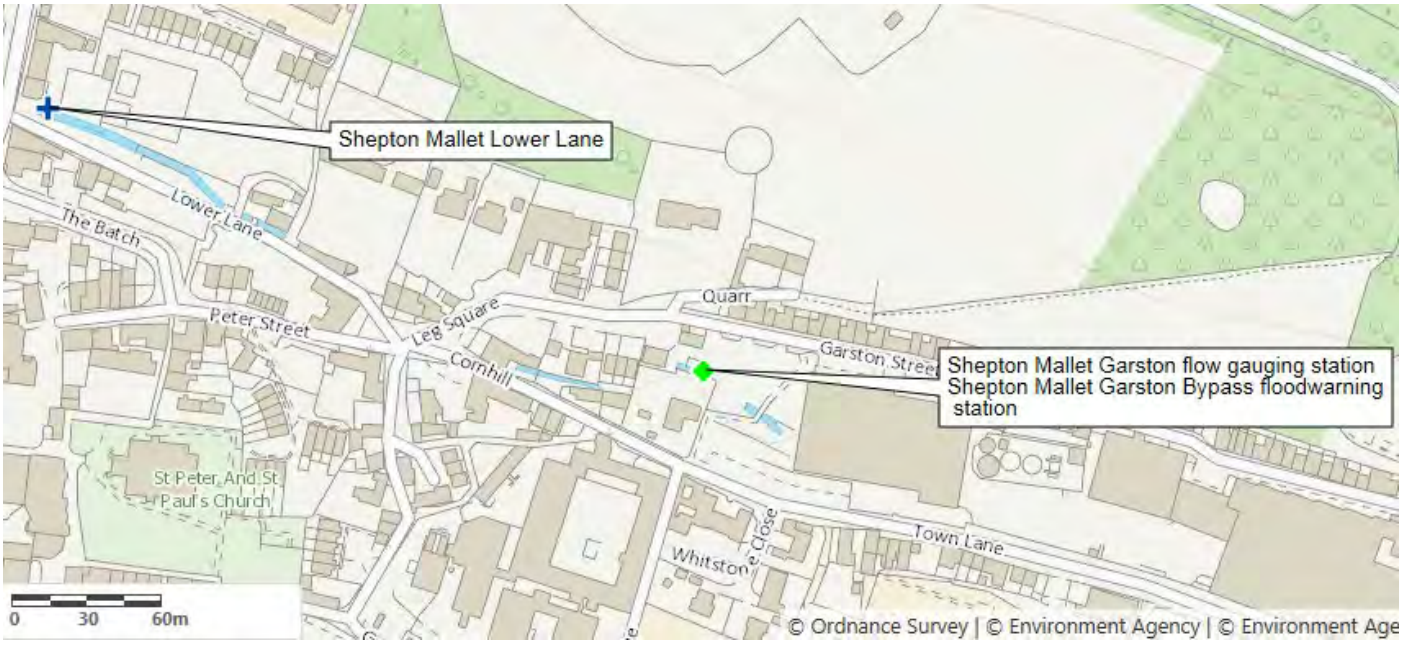


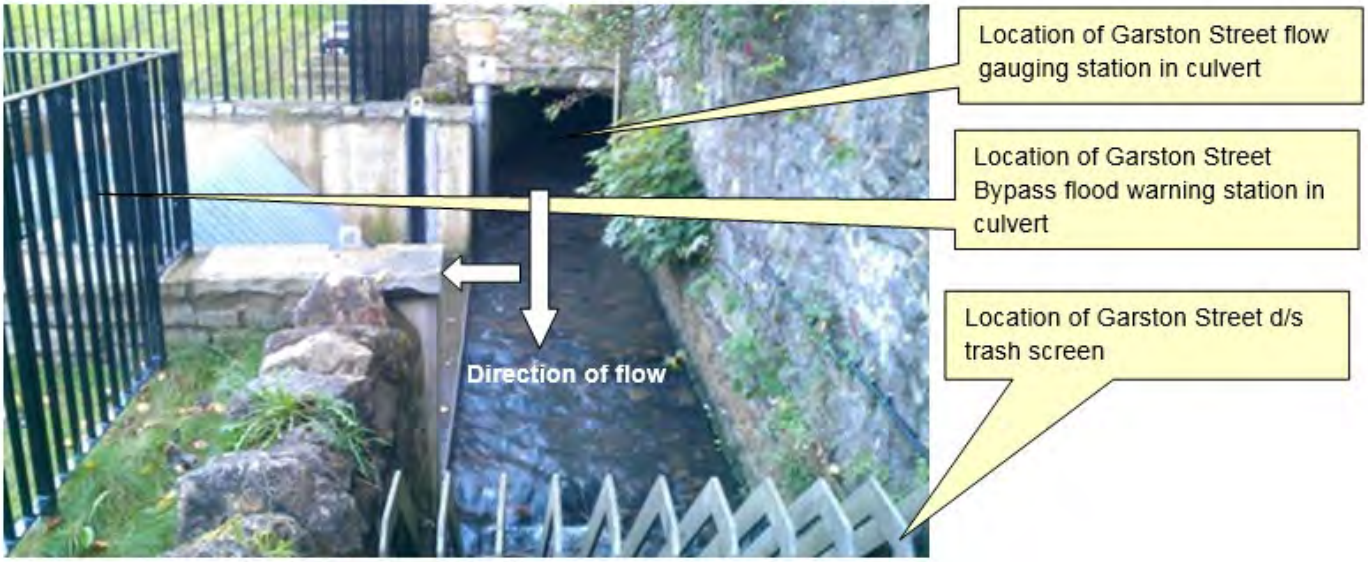
Figure 4-5 - River Sheppey – Catchment at Garston Street, Shepton Mallet (8.3km2)



Site map of River Sheppey at Garston Street culvert. Map shows location of primary and bypass culverts and location of the river level instruments



Site map of Shepton Mallet showing relative locations of Shepton Mallet Garston and Shepton Mallet Lower Lane water level recorders



Site photo of Shepton Mallet Garston flow gauging station and Shepton Mallet Garston Bypass flood warning station

Figure 4-6 – River Sheppey – Monitoring Stations

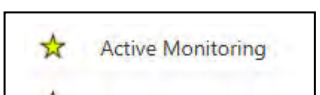
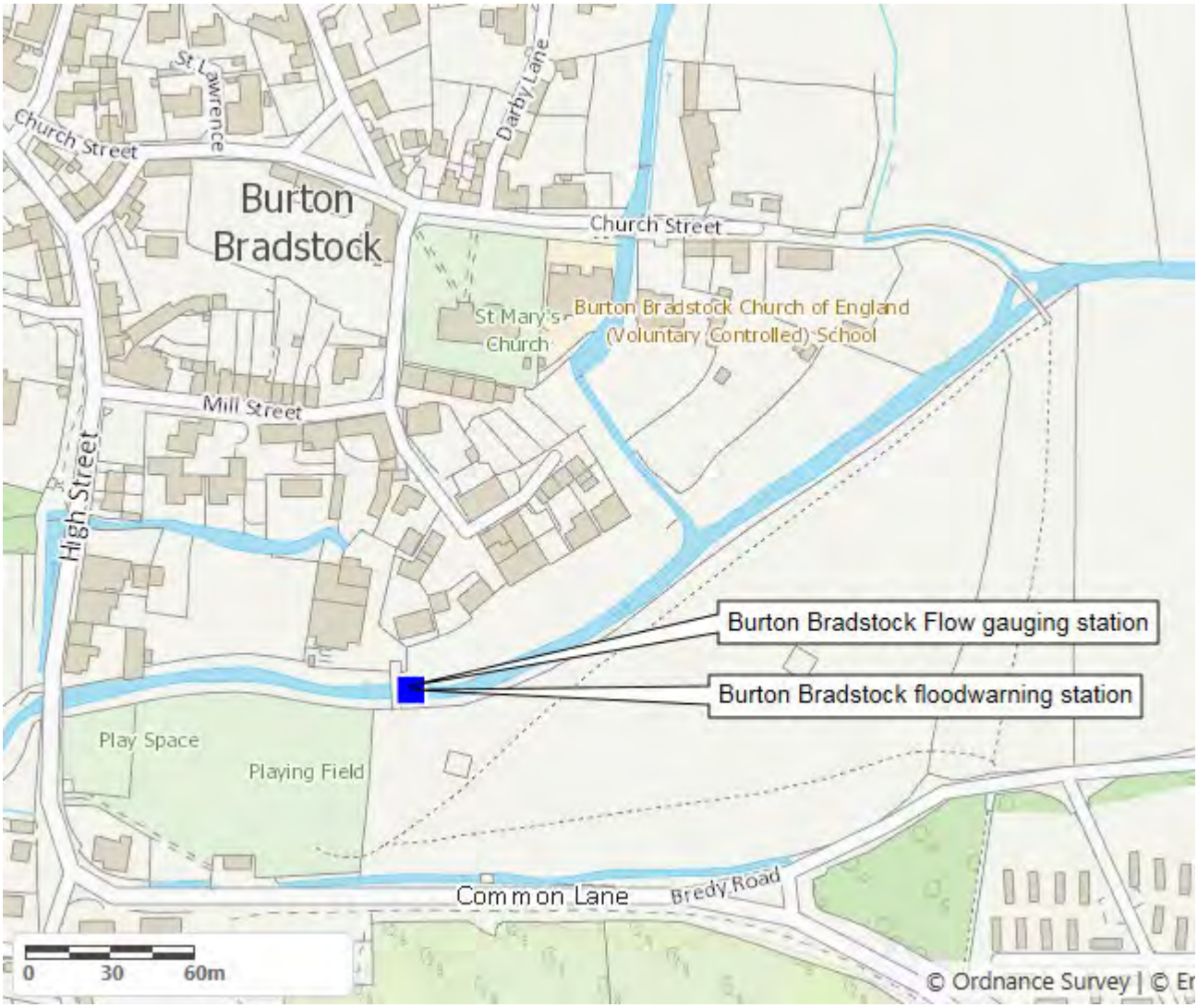


Figure 4-7 – River Bride - Catchment at Burton Bradstock (46km2)



Site map of the co-located Burton Bradstock floodwarning and flow gauging stations

Site photo of Burton Bradstock flow gauging and flood warning stations

Site photo showing the access to Burton Bradstock flood warning station

Figure 4-8 – River Bride – Monitoring Stations

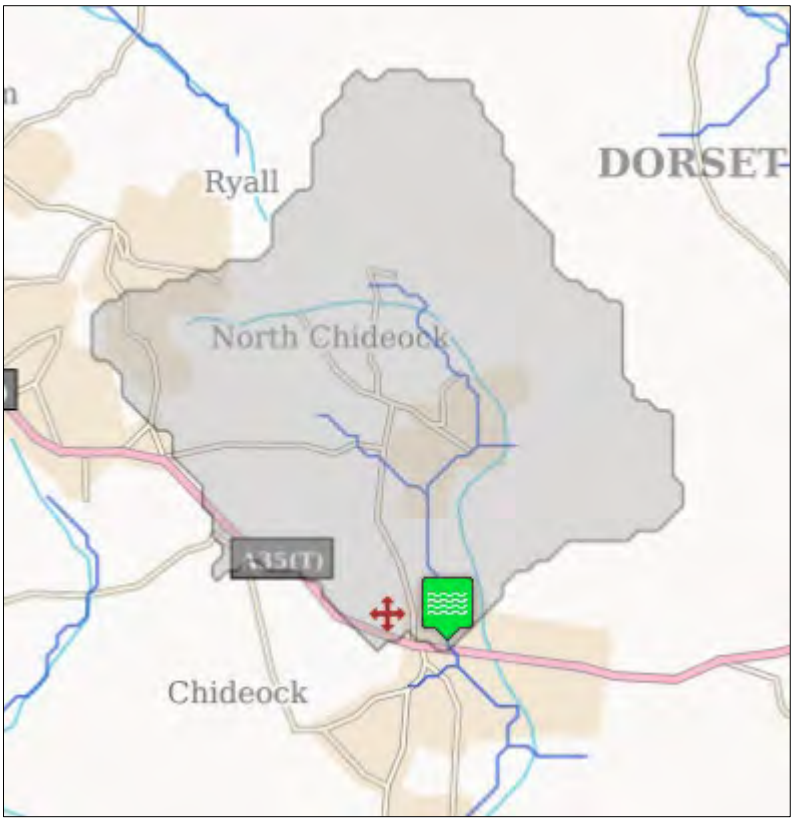


Figure 4-9 – River Winniford - Catchment Chideock (4.9km2)

Site map showing relative locations of the Chideock floodwarning station and the nearest flow gauging station at Bridport Magdalen Lane

Figure 4-10 – River Winniford – Monitoring Stations

Site photo of Chideock floodwarning station

Site photo of Bridport Magdalen Lane flow gauging station

4 Available Data

All datasets supplied for the project must be returned to the *Client* upon project completion. Datasets returned should adopt the appropriate security marking, be password protected/encrypted in accordance with the latest government guidelines. Requirements for the handling of project data are covered by the framework schedules. Note that the *Consultant* shall allow for 20 working days in their programme to receive the hydrometric data from the *Client*. Data that will be made available to the *Consultant* include:

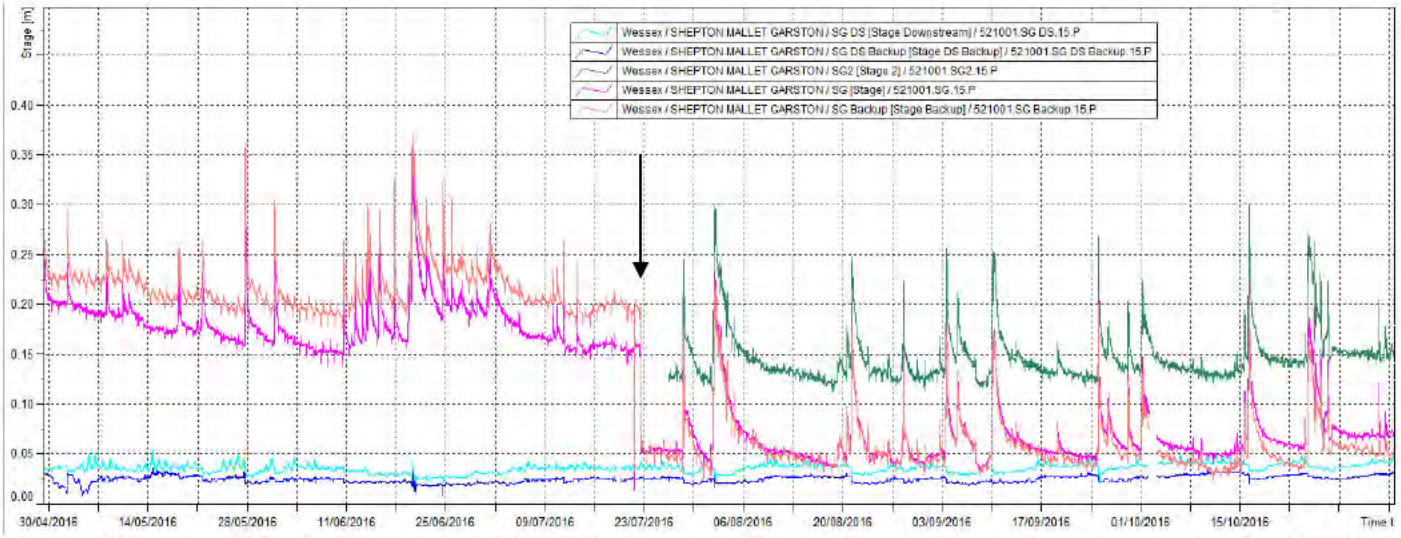
4.1 Hydrometric Data

Station	Location	Type	Period of record	Time interval	Fluvial/ Coastal	Known data quality issues
Bredy Farm	Closest to Burton Bradstock and relatively close to Chideock SY5072889984	Rainfall	04/1995 to Present	15 min		
Eggardon Hill	Relatively close to Burton Bradstock SY5502493979	Rainfall	04/2007 to Present	15 min		
Friar Waddon	Relatively close to Burton Bradstock SY6522885769	Rainfall	04/1995 to Present	15 min		
Birds Hill	2nd Closest to Sampford Brett ST0564136250	Rainfall	02/2002 to Present	15 min		
Quantock Farm	Closest to Sampford Brett ST1600136843	Rainfall	05/2006 to Present	15 min		
Maundown	Relatively close to Birds Hill and Quantock Farm ST0648129138	Rainfall	12/1994 to Present	15 min		
Doulting	Closest to Shepton Mallet Garston Street Bypass ST6459541748	Rainfall	03/2010 to Present	15 min		
Downhead Resr	Relatively close to Doulting ST6865645741	Rainfall	10/1991 to Present	15 min		
Stoke Bottom	Relatively close to Doulting ST6616048053	Rainfall	10/1991 to Present	15 min		
Lucott Farm	Closest to Porlock Parsons Street SS8745345013	Rainfall	08/2008 to Present	15 min		
Selworthy East Lynch	Relatively close to Lucott Farm SS9272746455	Rainfall	03/2008 to Present	15 min		

West Dunkery	Relatively close to Lucott Farm SS8741841716	Rainfall	10/1993 to Present	15 min		
Lodge House Farm	Closest to Chideock SY40289794	Rainfall	04/1995 to 05/2010	15 min		
Marshwood Lodge House Farm	Closest to Chideock SY4027697936	Rainfall	04/2010 to Present	15 min	l	
Raymonds Hill (Devon)	Relatively close to Marshwood Lodge House Farm SY3211496864	Rainfall	02/2008 to Present	15min		
Beaminster Coombe Farm	Relatively close to Marshwood Lodge House Farm ST4807500357	Rainfall	02/2008 to Present	15min		
Burton Bradstock (flood warning)	SY 48840 89362	Level	01/1998 to Present;	15 min	Fluvial	
Burton Bradstock (flood warning)	SY 48840 89362	Level (backup)	03/2016 to Present	15 min	Fluvial	Largest flood event (2.93m) is 0.13m higher than the co-located flow gauging station
Burton Bradstock (flowgauging)	SY 48839 89363	Flow & Level	06/2010 to Present	15 min	Fluvial	
Chideock (flood warning)	SY 42297 92818	Level	03/2007 to Present	15 min	Fluvial	
Bridport Magdalen Lane (flow gauging)	SY 45994 92854	Flow & Level	07/2009 to Present	15 min	Fluvial	
Porlock	SS 88520 45970	Level	07/2012 to 08/2016	15 min	Fluvial	
Porlock Parsons Street (flood warning station, PTX)	SS 88578 46564	Level	01/1998 to Present	15 min	Fluvial	Noticeable drift error. Insensitive to higher floods. Calibration needed
Porlock Parsons Street (PTX2)	SS 88578 46564	Backup level	07/2016 to Present	15 min	Fluvial	Insensitive to higher floods. Calibration needed
Porlock Parsons Street (bubbler)	SS 88578 46564	Level 2	07/2016 to Present	15 min	Fluvial	Largest flood event (0.3m) is 0.14m higher than FW station
Porlock Parsons Street Radar (flow gauging)	SE 88587 46598	Flow & Level	07/2016 to Present	15 min	Fluvial	Largest flood event (0.39m) is 0.23m higher than FW station

Shepton Mallet Garston (flow gauging in culvert)	ST 62200 43709	Flow & Level & backup level	22/07/2016 to Present	15 min	Fluvial	Discontinuity in water level data on 22/07/2016
Shepton Mallet Garston (measures standing wave immediately downstream of the culvert)	ST 62200 43709	Level & Backup level	07/2011-22/07/2016	15 min	Fluvial	Appended graph shows the discontinuity in water level data on 22/07/2016. This data is inconsistent with the water level used to estimate the flow.
Shepton Mallet Garston (measures standing wave at mouth of culvert)	ST 62200 43709	Level 2	22/07/2016-to Present	15 min	Fluvial	
Shepton Mallet Garston Bypass (flood warning)	ST 62200 43709	Level & Backup level	04/2011 to Present	15 min	Fluvial	
Shepton Mallet Garston (d/s trash screen in main channel)	ST 62200 43709	Level & Backup level	04/2011 to Present	15 min	Fluvial	
Shepton Mallet Lower Lane (u/s trash screen)	ST 61935 43815	Level & Backup level	04/2011 to Present	15 min	Fluvial	
Shepton Mallet Lower Lane (d/s trash screen)	ST 61935 43815	Level & Backup level	04/2011 to Present	15 min	Fluvial	
Sampford Brett	ST 09018 40404	Level	05/2004 to Present	15 min	Fluvial	
Sampford Brett	ST 09018 40404	Backup level	01/2012 to Present	15 min	Fluvial	
Williton	ST 07782 40887	Level	10/2004 to Present	15 min	Fluvial	
Williton	ST 07782 40887	Backup level	01/2012 to Present	15 min	Fluvial	
Williton	ST 07782 40887	Flow	05/2018 to Present	15 min	Fluvial	
Swill Bridge	ST 08846 42863	Flow & Level	10/2000 to Present	15 min	Fluvial	Missing gap between 01/02/2001 & 17/02/2003 Unchecked between 01/10/2000 & 01/02/2001

Swill Bridge	ST 08846 42863	Backup Level	02/2002 to Present	15 min	Fluvial	A lot of large +ve and –ve data spikes from Apr 2012 onwards



Graph of Shepton Mallet Garston 15 minute water level timeseries data showing discontinuity in water level values (pink and crimson lines) on the 22nd July 2016 (black arrow)

Between 5th July 2011 and 22nd July 2016 the Shepton Mallet Garston stage and stage backup recorded the water level immediately downstream of the culvert and also measured a standing wave that was 0.13m higher than the water level in the upstream culvert. On the 22nd July 2016, a downward looking velocity recorder was installed in the culvert and the stage and stage backup water level recorders were moved from immediately downstream of the culvert to inside the culvert in order to avoid measuring the 0.13m standing wave. The Shepton Mallet Garston stage 2 water level recorder measures the standing wave immediately downstream of the culvert containing the velocity recorder. **The Shepton Mallet Garston observed stage and stage backup archived between 5th July 2011 and 22nd July 2016 are inconsistent with the same data archived after 22nd July 2016 and are approximately 0.13m higher.** The Shepton Mallet Garston stage downstream and Shepton Mallet Garston stage downstream backup water level recorders measure the water level immediately downstream of the main channel trash screen and are also downstream of the side weir to the bypass channel.

4.2 Asset Data Types

The *Client* will provide an AIMS Database containing all asset details at the beginning of the project. Assets to be included are:

- Raised Defences – Walls/Embankments
- Flood Storage Areas/Reservoirs
- Sluice Gates/Barriers
- 3rd Party Assets

4.3 Flood History Information

Event Date	Location	Data Type
1979	Doniford Stream	Flood Extent Flood Report
	Hawkcombe Stream	Flood Report
1989	Burton Bradstock	Flood Extent
2006, 2004, 2012,	Burton Bradstock	FRIS Records

2014		
1989, 1997, 2006	Burton Bradstock	Ground Photographs
2006, 2008	Shepton Mallet	Flood Extent
3rd-4th October 2020 (previously 2012 and 2016)	Croscombe	Ground Photographs, brief reports
2007, 2004	Chideock	Ground Photographs
2012	Chideock	FRIS Records

The following existing hydraulic models are available to inform the study:

- Chideock Flood Modelling (2012)
- Shepton Mallet (2014)
- Hawkcombe Stream (2011)
- Williton Flood Mapping Study (2015)
- Burton Bradstock Modelling Studies (2007 and 2008)

The following images provide information on the location of model nodes or surveyed sections:

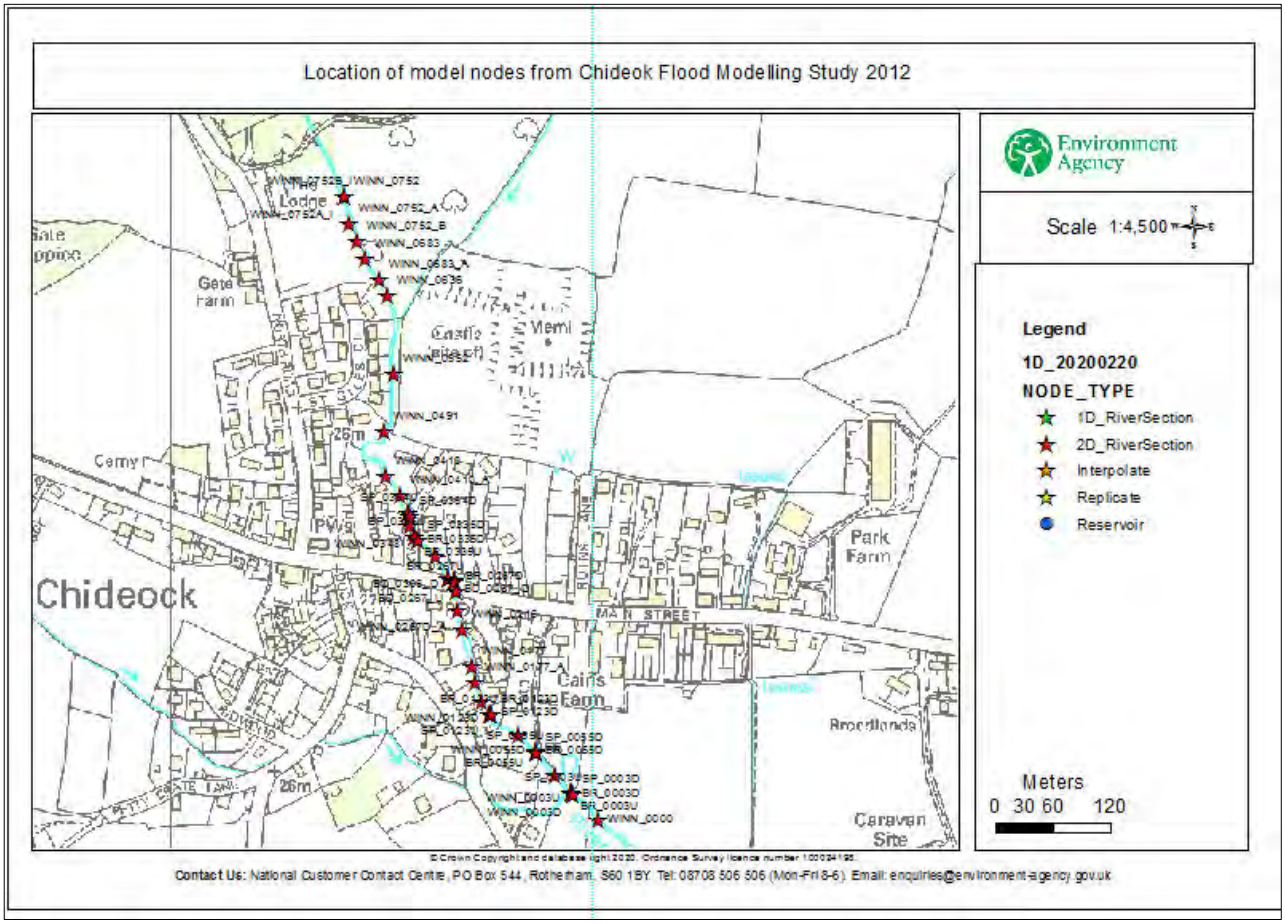


Figure 5-1 – Chideock - Model Nodes

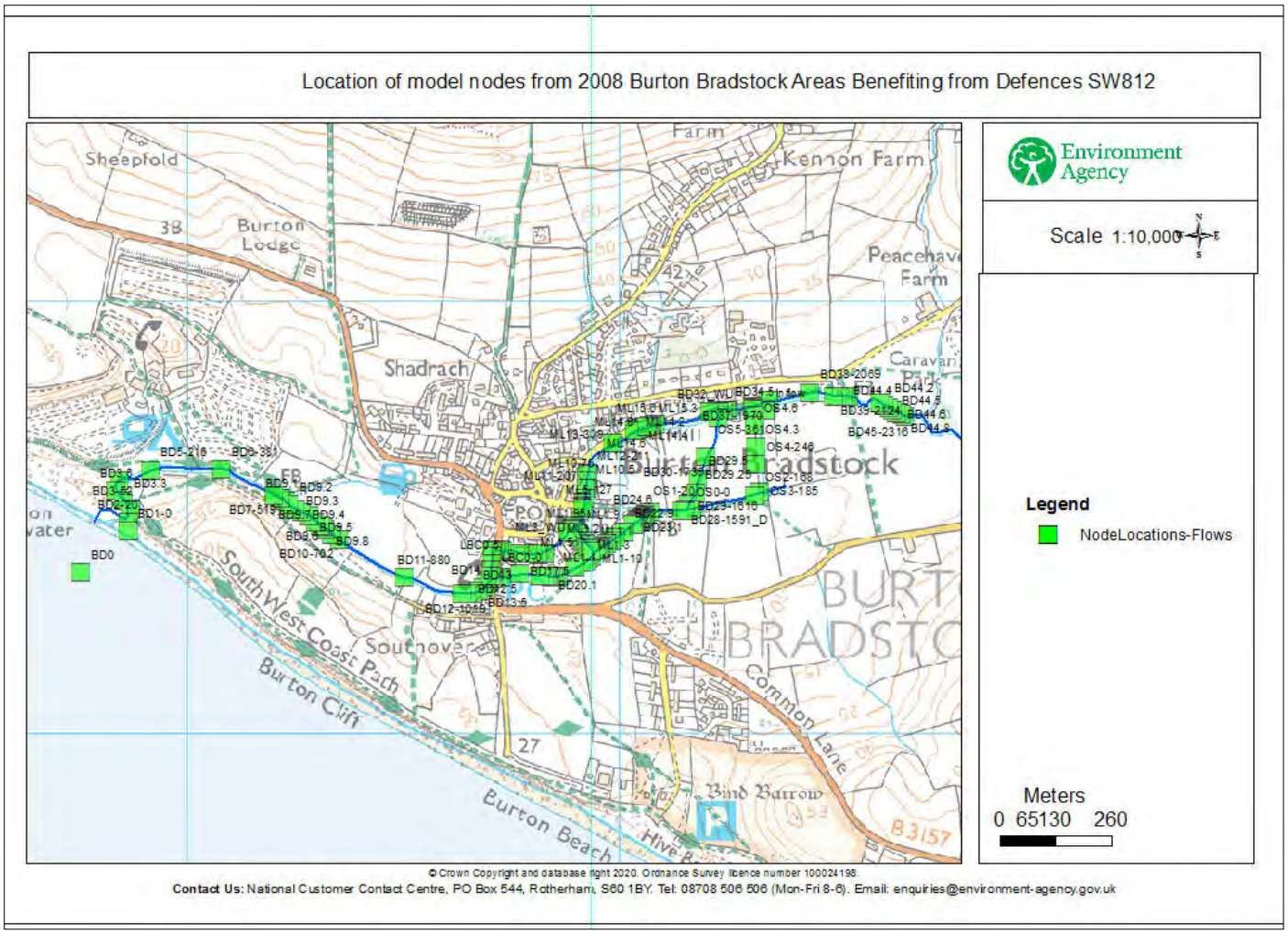


Figure 5-2 – Burton Bradstock - Model Nodes

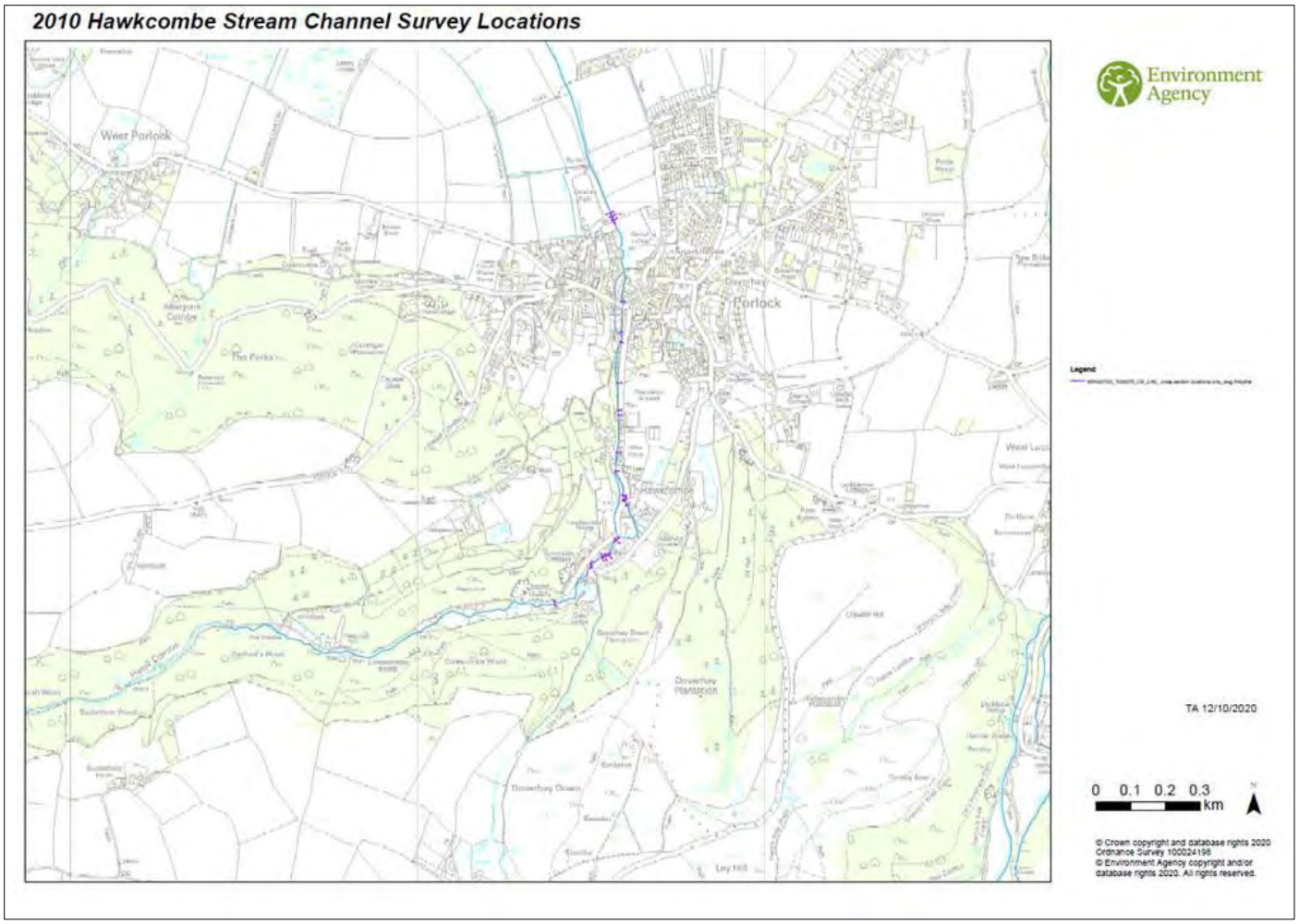


Figure 5-3 – Hawkcombe Stream - Survey Locations

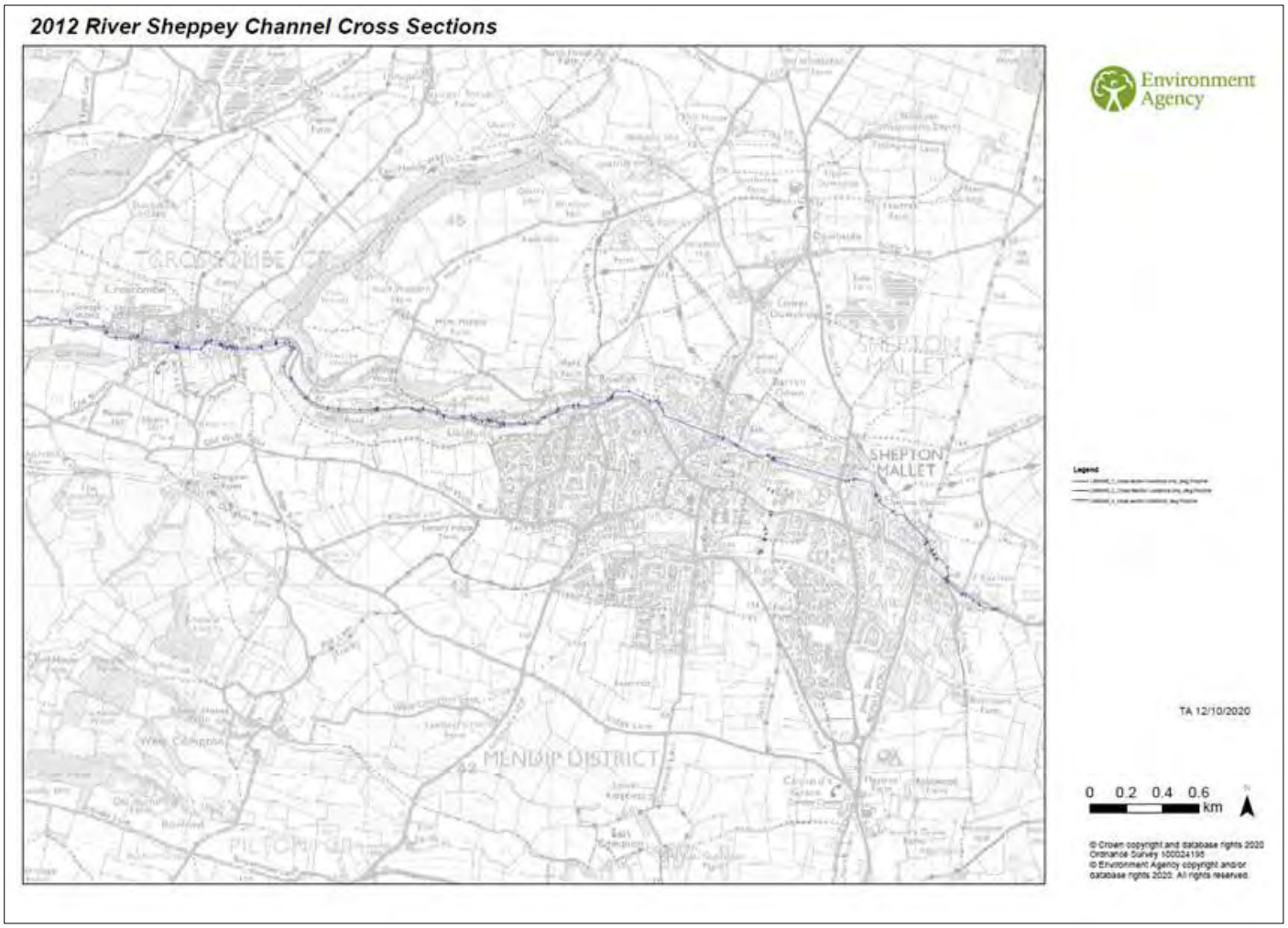


Figure 5-4 – River Sheppy - Survey Locations

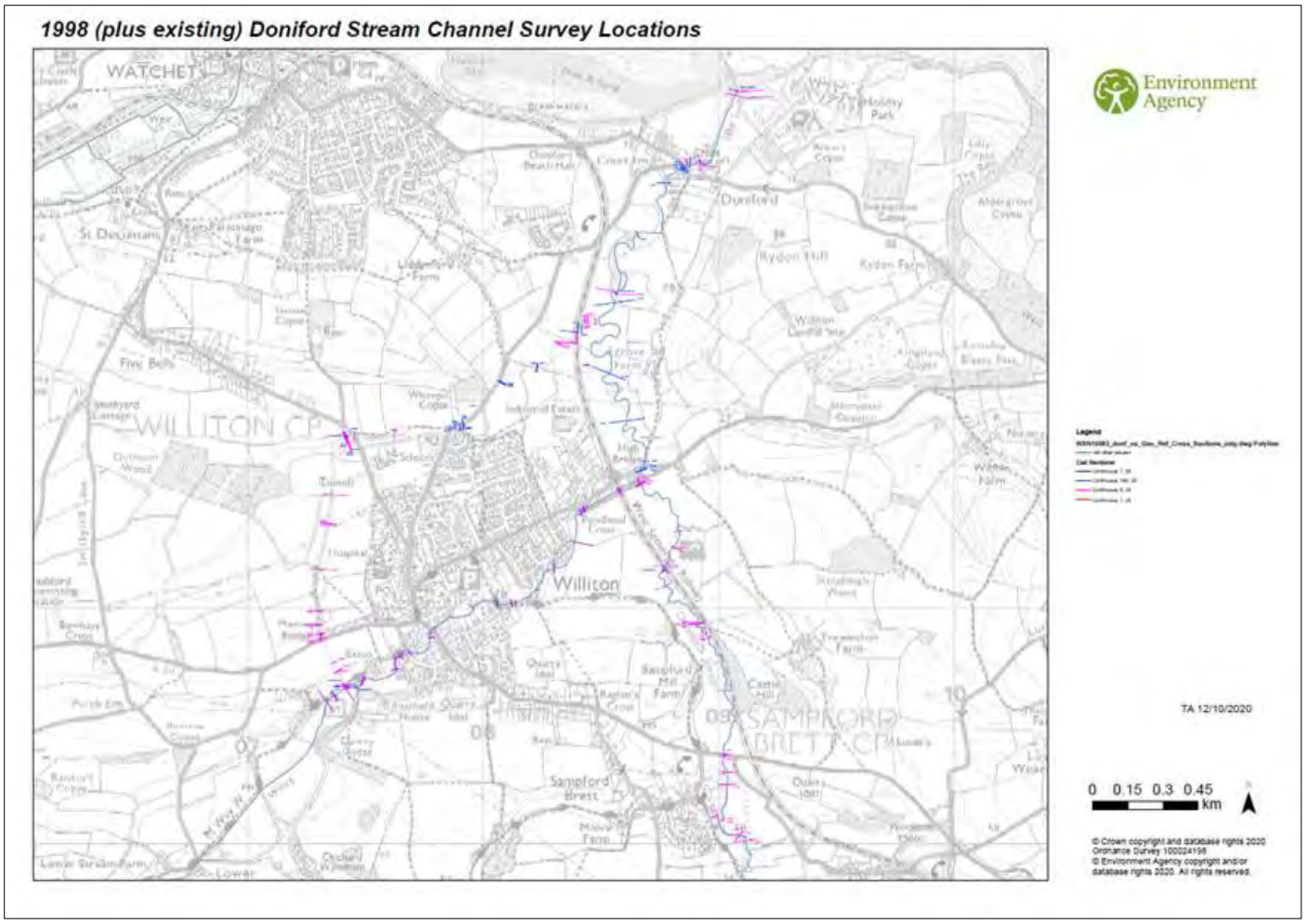


Figure 5-5 – Doniford Stream - Survey Locations

4.4 Existing Forecasting Models

The following maps show the availability of other flood forecasting models that could be used as donors or for informing the future development of PDM models for the 5 RRCs.

Current rain gauges are shown as green circles and forecast models are shown as blue triangles; Note that there are decommissioned rain gauges that may be worth reviewing.

The blue polygons define the upstream topographic area of the PDM flood forecast models.

A spreadsheet of FEH hydrological statistics is available for most of the below forecast models which may help in deciding if there is an appropriate analogue PDM model.

Figure 5-6 Chideock - NFFS Map of Telemetered Rain Gauge and Nearby Flood Forecast Models

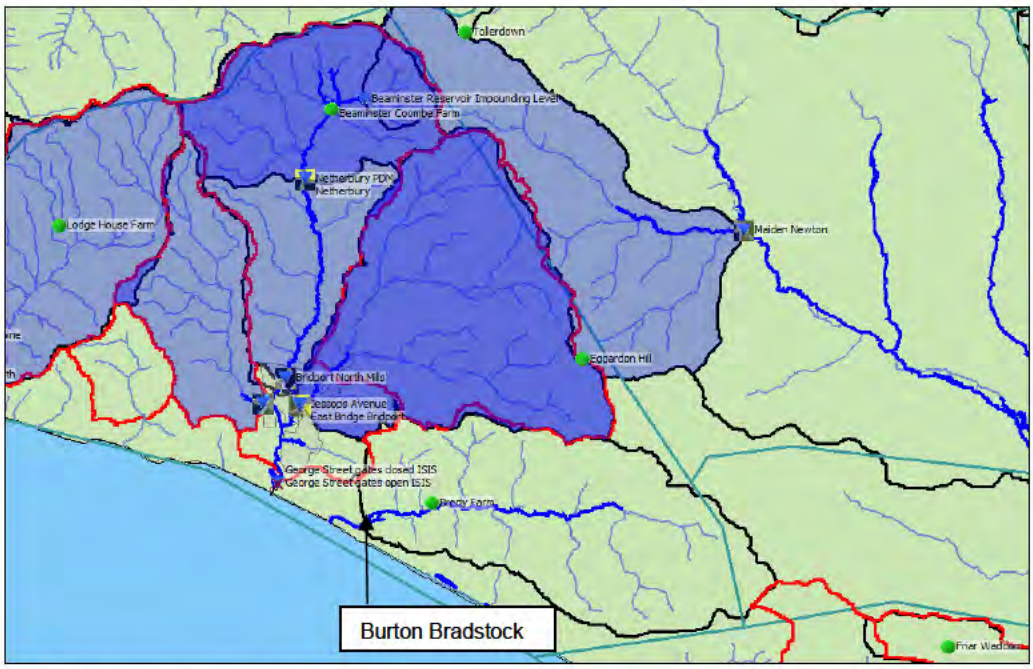


Figure 5-7 - Burton Bradstock - NFFS Map of Telemetered Rain Gauge and Nearby Flood Forecast Models

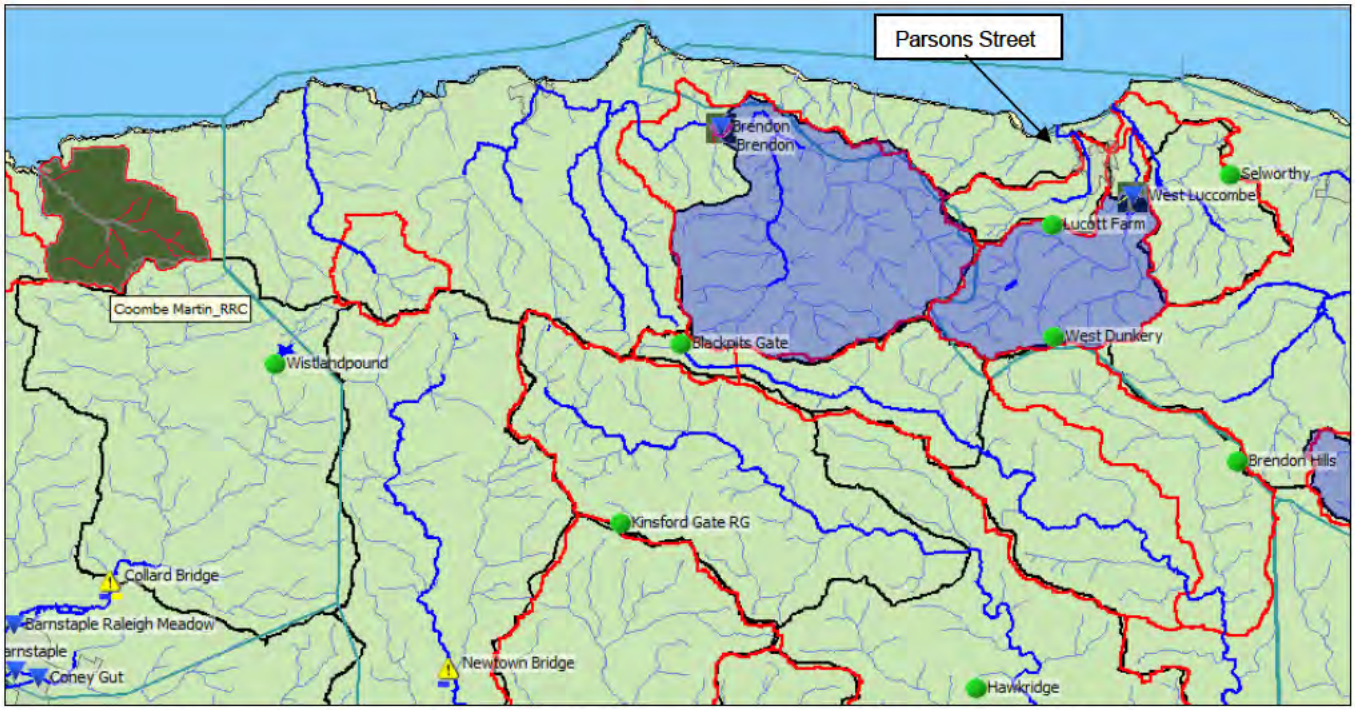


Figure 5-8 - Parsons Street - NFFS Map of Telemetered Rain Gauge and Nearby Flood Forecast Models

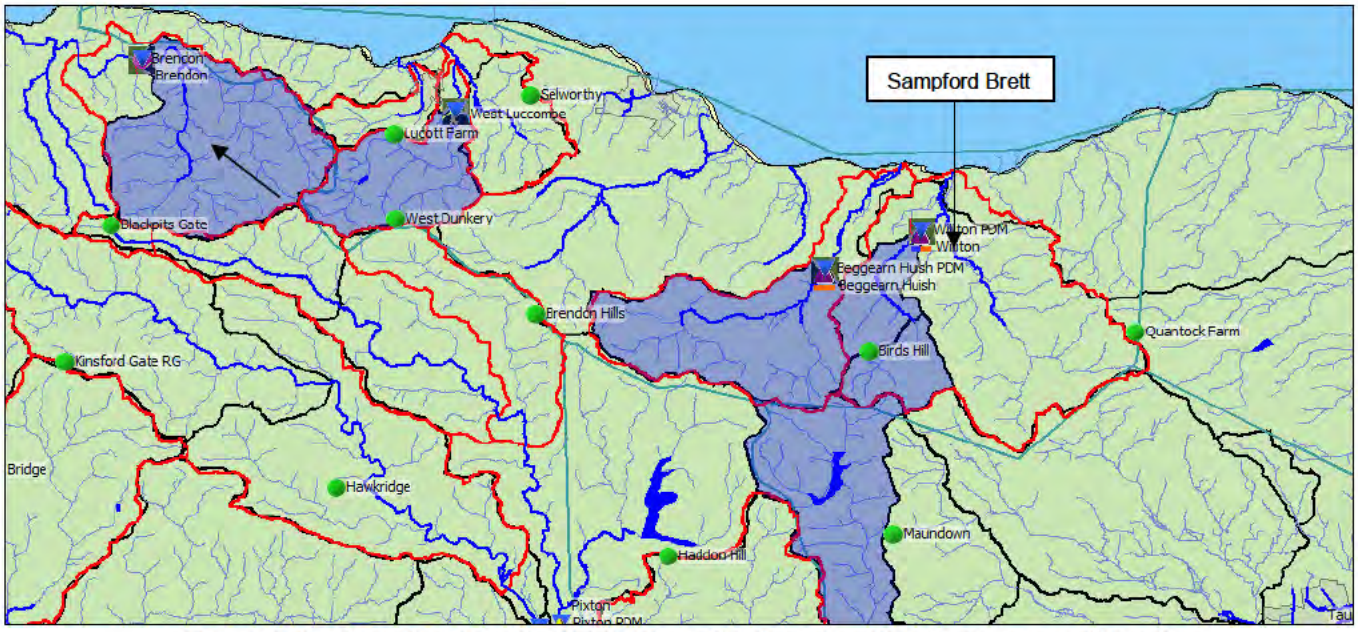


Figure 5-9 - Sampford Brett - NFFS Map of Telemetered Rain Gauge and Nearby Flood Forecast Models

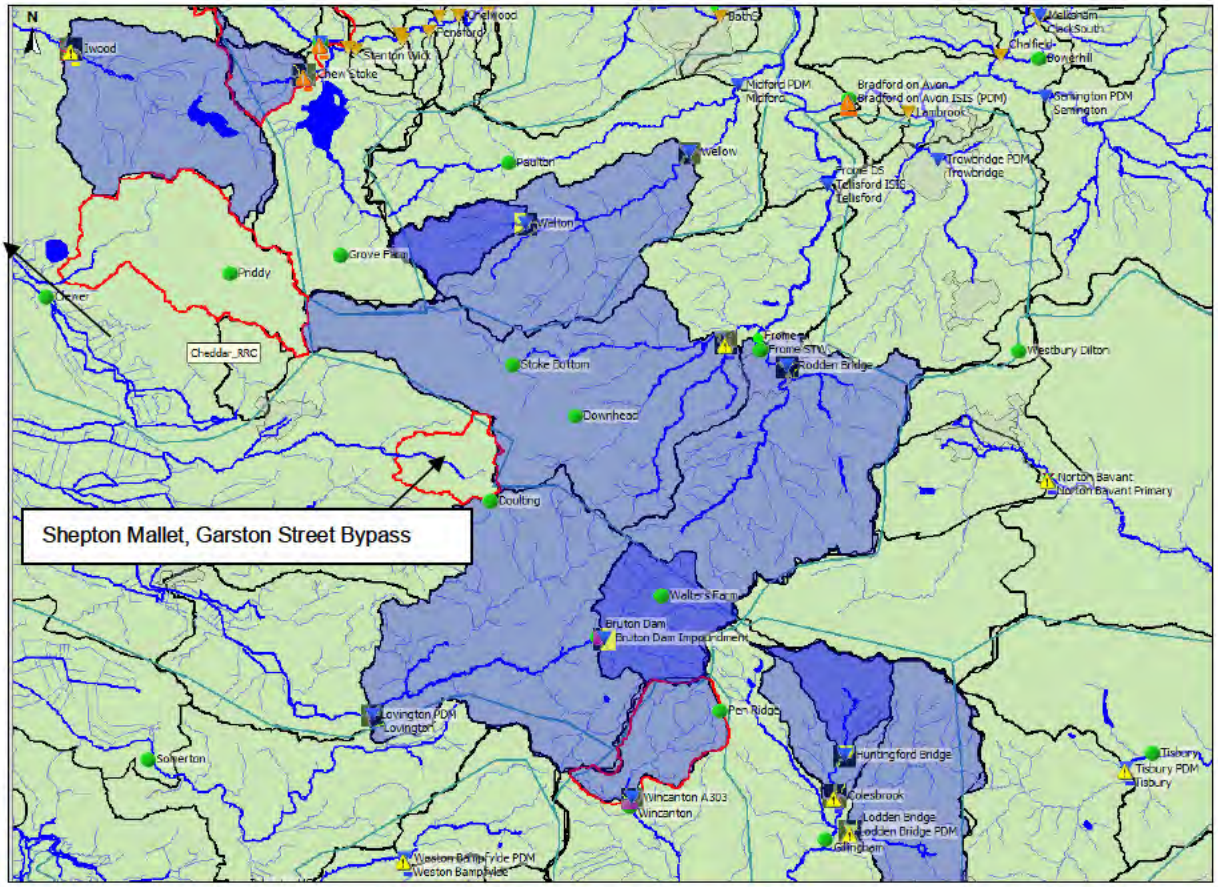


Figure 5-10 - Shepton Mallet, Garston Street Bypass - NFFS Map of Telemetered Rain Gauge and Nearby Flood Forecast Models

5 *Consultant* Programme

5.1.1 In managing the service, the *Consultant* shall follow all the requirements as set out in the Modelling & Mapping Framework schedules and the relevant content of the Minimum Technical Requirements.

5.1.2 The overall management of the commission shall:

- Contribute monthly to the updates to the project risk register.
- Attend progress meetings.
- Produce monthly financial updates and forecasts meeting the *Client's* project reporting timetable together with progress reports. Monthly financial updates and forecasts to meet EA deadlines provided by **no later than the 10th day of each month** or otherwise agreed at the project start up meeting. · Deliver a monthly progress report in the *Client's* standard template giving progress against programme, deliverables received and expected and financial and carbon summary against programme.
- Attend project board meetings as required.
- Ensure quarterly input into framework performance assessment/environmental Performance Measures.
- Capture lessons learnt relevant to scheme delivery for the EA PM to include in the scheme lessons learnt log to be appended to the Inception Report.

5.1.3 The Consultant shall provide a detailed programme in Microsoft Project format version 2016 meeting all requirements of clause 31 of the conditions of contract.

5.1.4 The Consultant shall provide a baseline programme for the project start up meeting and shall update the programme monthly for progress meetings with actual and forecast progress against the baseline. The programme shall also include alignment and submission of the BIM Execution Plan (BEP) and Master Information Delivery Plan (MIDP), see Appendix D.

5.1.5 The programme shall cover all the activities and deliverables in the project and include all major project milestones from commencement to the end of the reporting.

5.1.6 The programme shall identify key resources for each task on the programme and shall submit CVs for *Client* consideration.

5.1.7 The programme shall include for submission for *Client* approval and time allowance for the *Client's* approval process (minimum 10 working days), time allowances for data requests (minimum 20 working days) and time risk allowances for activities at risk of delay.

5.1.8 An updated programme shall be provided monthly with the progress reports, indicating % progress against the activities and % spend.

5.1.9 The contract will be administered using FastDraft.

6 *Relevant Guidance*

Ref	Report Name	Version
	Minimum Technical Requirements for Modelling	V3.1
LIT 56380	Real Time Model Development Guidance	June 2021
LIT 14089	High curve rating flow development using hydraulic models	July 2021
LIT 11832	Flood estimation handbook	July 2020
LIT 18749	National Standard Technical Specifications for Surveying Services	5.0
LIT 18748	Environment Agency national surveying specifications guidance for users	April 2021
LIT 18750	NEC4 professional services contract (PSC) - Survey Scope Template	2.0
LIT 11468	Threshold setting in flood incident management (55_07)	October 2010
LIT 56326	Fluvial Modelling Standards	3.0